



QUARTERLY STATUS REPORT NO. 11

1 October 1967 - 31 December 1967

Contract Number NSR 37-004-006

Southeastern State College
Durant, Oklahoma

Leon Hibbs
President
Chairman of TUSC

Lee B. Zink
Director of TUSC

TECHNOLOGY USE STUDIES CENTER

SOUTHEASTERN STATE COLLEGE
DURANT, OKLAHOMA 74701

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by
Lee B. Zink

January 1968

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P R E F A C E

This Quarterly Status Report covers Center activity from 1 October 1967 through 31 December 1967. The report was prepared by Dr. Lee B. Zink, Director of the Center, with the assistance of the entire staff. It is the eleventh quarterly report of the activity under NASA Contracts since TUSC was founded.

January 1968

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S U M M A R Y

The technology utilization phase of the TUSC program accelerated during the quarter with the addition of ten (10) new clients. Twenty-four (24) technology transfers were recorded. A wide segment of the industrial community of southeastern Oklahoma is using TUSC services.

TUSC Bulletin #5 was distributed to several hundred interested persons in the area. Supplement number one (1) to the economic profile data was also distributed to a wide user audience.

TUSC staff personnel actively participated in five (5) programs and/or seminars relating to technology utilization. These were in both Oklahoma and Texas.

TUSC telephone and mail service to clients outside the Primary Area has been effective; however, some parameters of the experimental structure have been modified to allow personal contact.

A good working relationship has been established with a large firm. This is another of TUSC's experimental programs.

Activity in provision of services to faculty members at several institutions continues to increase.

Technology Utilization Program

During the quarter the technology utilization phase of the TUSC program maintained satisfactory progress with a slightly accelerated pace. Ten (10) new clients became active during the period. Some 845 technical reports were provided to clients. Twenty-four (24) additional technology transfers are reported below.

The following is a continuation of the reporting procedure for transfers of technology established in Quarterly Status Report Number 2 and continued in subsequent reports. The first section involves the updating of previously reported transfers. The numbers used are those given the transfer when originally reported.

34. The peanut drying project--to relate the knowledge of heat transfer generated in the aerospace industry to the problem of drying peanuts--continues to await adequate financing. It is our understanding that the United States Department of Agriculture is currently studying the possibility of funding the first phase of the project jointly with the Oklahoma Peanut Commission.

103. Problem - To determine the applicability of a specific process using air compressors and air pumps.

Solution - This client has invented a new type carpet cleaning machine. It utilizes the high pressure pump used for automatic car wash machines for the cleaning. A certain amount of moisture is retained by the carpet and must be eliminated. A search was done last quarter on the problem but after reading the NASA reports the client felt he was approaching the problem in the wrong manner. The previous search related to high volume air machinery.

The current search was keyed to "Devices to Produce Large Volumes of Air." In the search, abstracts on machinery that produce high volumes of air and could be bought commercially were found. The client feels that his problem has been solved.

104. Problem - To determine processes to separate liquid and solid in human waste.

Solution - This client is the inventor of an electrically fired incinerator. He is attempting to devise additional ways to better utilize the machine. One possible use would be to dispose of human waste, but the moisture content appeared to be too high. A search was done in STAR and IAA which produced nine (9) abstracts. One abstract in particular was very good and the report was ordered. It was N66-25488, "The Use of Incinerators for Treatment of Combustible Wastes." The client feels that this information will allow necessary modification of the incinerator.

105. Problem - Vibration in heat exchange tubing.

Solution - Pertinent report number NASA TND-4189 was forwarded to this client in supplement to an original search made some three (3) months ago. He indicated that information contained in this report was directly applicable to his problem.

106. Problem - Current information relating to time-motion studies to be used in examining plant efficiency.

Solution - Fifteen (15) abstracts covering the general area of time-motion study were retrieved by manual search. The client selected six (6) reports from these abstracts. He indicated that they provided excellent information for devising a study of his own operation.

107. Problem - A client requested a state-of-the-art search on Velocity Lock Servos.

Solution - Ten (10) abstracts pertinent to this problem were retrieved. The client indicated that they had specific bearing on his problem.

108. Problem - A client asked for information to be used in evaluating a concept for forage handling.

Solution - The Center provided the client with three (3) reports on the state-of-the-art in this area. An industrial specialist visited with machinery manufacturers and assembled statistics which indicated the client's project was not economically feasible. He has dropped it due, in part, to our assistance.

109. Problem - A client needed information about material suitable for replacing metal in a Servo.

Solution - Five (5) pertinent abstracts and five (5) magazine articles were retrieved. This material provided the client with specifications on plastics from which he selected the proper material.

110. Problem - To determine the state-of-the-art of Dip Brazing.

Solution - This client is considering locating one of his manufacturing plants in southeastern Oklahoma. He toured the Southeastern State College campus and TUSC facilities and was amazed by the vast amount of technical information that is available. The company is in the business of manufacturing boat accessories, specifically windshield and boat top equipment. He asked for information on Dip Brazing that would apply to fabrication of his

product. A search was done in STAR and IAA, and several abstracts were located that were pertinent to the subject. Dip Brazing is a relatively new process that has been developed in the past few years and is proving successful in welding small aluminum parts. Three (3) abstracts were found: A66-15002, "Joining Aluminum to Stainless Steel for Space Vehicle Applications," A67-23007, "Aluminum Dip Brazing," and N64-18979, "Brazing Sap-2 Sintered Aluminum Powder." Report number A67-23007, "Aluminum Dip Brazing," was ordered by the company. Additional information from open literature was provided. The client indicated that he was very pleased with the information. The company plans to relocate his Texas facilities in southeastern Oklahoma.

111. Problem - How is a finely ground slurry separated into particles of 1 micron, 1 to 4 microns, 4 to 10 microns, and 10 microns and larger?

Solution - A conference was arranged with TUSC personnel, representatives of the SSC Physical Science Department and the engineer of the company attending. The engineer explained that he was sizing machinery for developing a copper deposit. He needed to know whether or not the mineral was evenly distributed in the particle sizes. So much capital would be invested in machinery that it was imperative for them to know if it was necessary to process all of the particles.

The conference disclosed that laboratory methods existed for separating these particles in accordance to size. The client was advised to use a combination centrifuge-filter system. The client

was furnished with seven (7) abstracts among which the most pertinent appear to be N65-24318, "Particle Size Analysis in the Sub-sieve Range with an Awre Centrifugal Photosedimentometer," and N66-25218, "A Comparison of Different Methods of Particle Size Analysis." The other abstracts furnished were N67-29707, N64-11277, N65-29608, N66-14692, and N67-12415. The latter reports gave the client a broader background for accomplishing separation. Additionally, TUSC provided AD 65-3578, "A Review of the State-of-the-art of Cyclone-Type Separates." The client believes that the discussion and the reports cited will give him confidence in the integrity of his findings and allow him to proceed to the next step in the copper mine development.

112. Problem - What is the state-of-the-art of UHF/SHF Solid State Circuits?

Solution - A company asked TUSC for current information on the state-of-the-art of UHF/SHF solid state circuits. These systems have been used to provide data on flight dynamic gun-launched vehicles. The company has submitted a proposal to the Department of Defense and was one of the top contenders for the bid. A search was done in STAR and IAA which resulted in a retrieval of nine (9) abstracts. All the abstracts retrieved were written in 1967. A search was done last year in the 1964, 1965, and 1966 STAR and IAA. A total of eight (8) abstracts were sent to the company. We were informed that the information provided was valuable.

113. Problem - Information on seismograph processes for a state-of-the-art study.

Solution - A student became aware of the services of TUSC through a seminar held at the Grayson County College. The

student's instructor referred him to TUSC as a possible referral library in the science field. He asked TUSC for the latest information on seismograph processes. A search was done in the open literature in STAR and IAA. Abstract N67-15426, "General Seismology" was found and also abstract N67-14380, "Technological Progress in Seismology Crystal Motion Wave Theory Propagation and Related Topics." This transfer falls under the classification of TUSC general educational endeavors. It takes little effort to expose selected students to the NASA file, and it could have significant future rewards.

114. Problem - General information on oil field corrosion prevention.

Solution - Corrosion in the oil field is a common problem to which no positive solutions have been found. Each individual oil well appears to have different corrosion problems since each has different contaminants. The company has approximately sixty (60) oil wells in eastern Oklahoma. Several of their wells produce an iron oxide that is unique to the eastern Oklahoma area. The company has contacted several oil field corrosion companies, and the only solution they have found has been filtering systems which cost about \$60.00 a day to filter each well. A search was conducted in the open literature, the TUSC library, STAR and IAA. Nine (9) abstracts of STAR listings were sent. The company has indicated that this information is guiding them to a cheaper solution to the corrosion problem.

115. Problem - Information regarding radiation effects on humans.

Solution - This requestor is a student at Grayson County College and was introduced to TUSC services through his science instructor. He asked TUSC to locate information on radiation effects on humans. A search was done in the open literature which resulted in a large quantity of information. STAR produced three (3) abstracts. Also, three (3) reports were ordered: N66-15043, "Radiation Protection," N67-17085, "The Biochemical Effects in Radiation Damage," and N67-17081, "The Biochemical Primary Effects in Radiation Damage." This is another educational transfer.

116. Problem - Find state-of-the-art information on electroplating.

Solution - This client is in the business of engineering, design, and fabrication of electronic assemblies. The company previously had been contracting their machine shop electroplating out to other companies but found it more feasible and economical to set up their own plating process. They have installed approximately \$50,000.00 worth of electroplating equipment and are in the process of educating their employees to operate this machinery. A search was done in STAR and IAA, and thirteen (13) abstracts were found that were pertinent to the subject. They are building their training program based on this information.

117. Problem - To determine the latest information relative to numerically controlled machine tools.

Solution - The firm is in the precision machine work business. At the present time, they have subcontracts with major firms. They have recently secured a government loan to expand their facilities. They have purchased approximately \$250,000.00

worth of new machine tools in the past year. During their rapid expansion, training personnel has become a problem. The personnel they had in the past year were acquainted with the standard type machine tools; but during the expansion, several pieces of sophisticated machinery have been purchased. The company asked TUSC for any information they might use in educating their machine tool operators. An industrial application report was obtained and was sent to the company. The report was Y-1579, "Automatic Tool Setting for Numerically Controlled Machines." This report deals directly with numerically controlled and automatic tool settings. The purpose of the report was to aid machine tool operators with an automatic system of tool setting which could be integrated into the over all state-of-the-art of numerically controlled equipment. The company indicates it has been quite useful in their training program.

118. Problem - A local radio station desired latest information concerning FM stereo broadcasting. The station is considering installing this kind of equipment.

Solution - Tech Brief 65-10055, "FM Oscillator Uses Tetrode Transistor," along with the back-up package, was provided to the client. He has indicated that the information is exactly what is needed in order to make a decision as to the installation of the equipment.

119. Problem - To find information on types and uses of explosives in the U. S.

Solution - This company is engaged in mining and processing dolomite products. During the initial phase of the

operation, the material must be blasted with explosives in order to render it small enough to run through hammer-mills for pulverizing. The company had tried several sources for this information and had not been able to obtain what they needed. A search of the NASA file did not provide the necessary information. The next step was to contact the Institute of Makers of Explosives in New York who provided the necessary information. TUSC performed a valuable switching service which allowed solution of this client's problem.

120. Problem - To obtain general information on utilization of soybean products.

Solution - This client asked for any information on processing and utilization of edible soybean products. He feels that soybeans are not being utilized as extensively as they should in this region. Soybeans are becoming a major agricultural product in southeastern Oklahoma. The client (who is an active, ordained minister) inherited a sausage processing plant that belonged to his late father and is faced with managing the operation. He is looking into the possibilities of utilizing soybean products as an additive to sausage. TUSC searched the NASA literature but found nothing on soybeans. A search of open literature in the SSC library uncovered a book, "Soybean Products" that had much pertinent material. The client indicated that the information sent could be very valuable to his operation in the future.

121. Problem - To obtain information projecting future aviation needs of the U. S.

Solution - The Director of the Aviation Program at Southeastern State College asked TUSC to look for any information on future aviation needs in the U. S. NASA report N67-30464, "Aviation Forecasts: Fiscal Years 1967-1977," was retrieved. This forecast deals with future pilot needs and airport facilities from the present to 1977. The Southeastern Aviation Program has been contacted by the Federal Aviation Agency in Washington to look into the possibilities of conducting an air space controller school in conjunction with the aviation school. Requirements for entry into the controller school are very rigid. A student entering the program must either have or obtain a private and commercial pilot's license with an instrument rating. The air controller program could be adapted quite satisfactorily into the college aviation program since it offers the ratings required for the controller school. The information contained in the report will provide the primary basis for further study relative to establishing this school.

122. Problem - To find information projecting future aviation needs of the U. S.

Solution - This client is the Chief Link Instructor for a private aviation training school. As a side business, he has a placement service for students who are entering the aviation field. Apparently, he has done quite well with this business and has expanded; but he needs more financing to take care of overhead. He is currently writing a plan of action to propose to bankers or other financial institutions in order to get the needed finances. NASA report N67-30464 was sent to the client. He indicated this report would be helpful in writing his plan.

123. Problem - To provide information through high altitude slides and photographs.

Solution - This client is an oil and gas lease broker in addition to his duties as a Catholic priest. He viewed the slides TUSC obtained from the Technology Application Center at the University of New Mexico. Although his examination is still in a preliminary stage, he has indicated that the slides have proven most valuable.

124. Problem - What is the state-of-the-art on zirconium chlorides? (A professor at Southeastern needed this in his own research activity.)

Solution - Professor Walker has been doing advanced research on zirconium chlorides. The aspect of the subject in which he was most interested was beyond the capability of the Center's personnel. Consequently, he was burdened with approximately 170 abstracts. From these abstracts he selected five (5) documents, AD 619244, N66-14998, N66-18751, N63-11027, and N65-16381. He was pleased and a bit embarrassed to find that one of the abstracts referred to an article in a two year old chemical journal that he had in his own library. One of the documents, N66-14998, he described as being the exact answer to his search. Mr. Walker described our service in this manner: "The Center has a library that can't be found, to my knowledge, in this area of Oklahoma, for that matter, it can't be found in Oklahoma. This library and staff offers an invaluable tool to the college personnel of this region. I have talked to professors in other colleges about this service in the interest of TUSC expanding to other college campuses. The

expansion will be easy because there is a genuine need for it."

125. Problem - How can minute quantities of liquids be injected into a high pressure flow of a dissimilar liquid?

Solution - The client did not know when he submitted the request that there were "off-the-shelf" metering devices that would meet his requirements. A search of NASA literature was made but produced little that would be of use to an "in-production" process. We checked our open literature and found several advertisements and brochures depicting suitable metering pumps. The client was able to solve his problem with this information.

126. Problem - The client is establishing an electroplating firm and requested latest information on electroplating techniques. His primary interest is in avoiding contamination of expensive plating solutions.

Solution - TUSC provided the client with NASA SP-5045, Contamination Control Principles, and commercial brochures from several major plating material suppliers. He indicated the material provided was very useful and has a potential cost savings of several thousand dollars.

The client in this case is establishing an electroplating shop designed to triple plate large automobile parts for antique and classic automobile enthusiasts over a several state area. This type of plating employs three (3) metals (copper, nickel, and chrome) with the chrome layer having a thickness of ten to twenty-thousandths of an inch. Most commercial plating shops dealing in auto parts plating use only nickel and chrome, with the chrome "flash plated" to a thickness of only two or three-thousandths of

an inch. The flash plating is not acceptable to the antique and classic auto enthusiasts.

The client has a standing order from one automobile museum and several automobile clubs in Oklahoma City, Tulsa, and Dallas for all their plating work. Their demands for quality are extremely high. In view of this, a quality plating will attract more customers; but one poor quality job will possibly cost the client several good customers. Contamination control and plating techniques developed through NASA research are therefore quite important and useful to this client.

The initial cost for materials and equipment which the client is using is approximately \$8,000.00. A major part of this cost is the three chemical solutions. The tank of nickel solution alone costs nearly \$2,000.00. If contamination is avoided, these solutions need never be changed completely. Periodic replenishment is all that is required.

The client has stated that the material provided him by TUSC will contribute significantly to his efforts in two ways. The NASA originated techniques of metal cleaning and preparation will help avoid contamination which could at one time ruin two to six thousand dollars worth of solution. In addition, the same methods will result in a higher quality plating which should prove more attractive to a type of customer who is very hard to please.

The above reporting of specific transfers points to the breadth of the clientele being exposed to TUSC technical information services. One would not normally expect ministers or priests

to be potential clients for technology transfer; however, TUSC experience indicates that there are exceptions.

The utility company project which was referred to in Quarterly Status Reports 9 and 10 is continuing but is making less than satisfactory progress. It appears that an additional educational effort aimed at the company's industrial engineers will be necessary. Only two (2) requests for additional information have been received to date. A thorough investigation of this activity is in process in order to rectify the situation, if possible.

Economic Data and Research Services

TUSC Bulletin #5, Employment Changes by Industry in Oklahoma from 1940-1960, by Professor Warren, Assistant Director and Regional Economist of TUSC, has been received from the printer and distributed to several hundred interested persons. The analysis done in this work will be useful in TUSC's future efforts aimed at measuring the impact of the Center. Additionally, publication of this effort added significantly to the growing body of knowledge relating to the economic problems of Oklahoma. Bulletins #3, #4, and #5 have been addressed to selected economic problems relating to the economic growth of Oklahoma and have assisted in establishing TUSC as a trusted source of information and expertise in the field of regional economic development. Such a reputation is quite important to the total TUSC program.

During the quarter, the volume which updates the previously published TUSC profile data was distributed to all who held sets of

the original volumes. The new volume, Human and Material Resources of (Atoka, Bryan, Carter, Choctaw, Coal, Haskell, Johnston, Latimer, LeFlore, Love, McCurtain, McIntosh, Marshall, Murray, Pittsburg, Pushmataha, and Sequoyah) County - A Profile for Growth and Development (Supplement 1), along with a shorter supplement updating the source notes, was sent to several hundred users.

General Center Functions

A request from the Oklahoma Governor's office allowed TUSC to combine its capabilities in the fields of technology and economic data in a practical response. The Governor's assistant for industrial development required technical information relating to the latest manufacturing methods used in the fiber glass industry along with information regarding locations of necessary raw material deposits in Oklahoma. TUSC was able to provide this data in a short period of time. There is a possibility that a new Oklahoma industry may come into being, partially from our efforts.

On 5 October 1967, TUSC presented a program on the campus of Grayson County College, Sherman, Texas. The invitation to make this presentation came from the president of that institution, as a result of the work of Dr. A. E. Shearer, former Southeastern president currently serving as a consultant to the Grayson County College. Attendees at the meeting included faculty members and selected friends from the industrial community of that area. The TUSC program was aimed at introducing the NASA TU program to the audience. TUSC did not actively seek new industrial clients from

among the group. However, several inquiries have been received from both faculty members and industry representatives. Also, faculty members have guided some of their superior students in the use of TUSC facilities.

On 19 November 1967 the TUSC staff presented a program to the Arkoma Chapter of the American Petroleum Institute. Twenty-five (25) members of the chapter attended the meeting. The TUSC program was structured to introduce the NASA TU program and to give specific examples of technology which might be useful to the oil industry. The presentation was well received; however, to date no active clients can be attributed to this meeting.

On 23 October 1967 Dr. Zink spoke to the Engineering Society of Tulsa regarding the NASA TU program with specific reference to the TUSC project. This group of some thirty (30) engineers had previously heard presentations from an ARAC staff member and from a NASA representative in Tulsa. They were a stimulating audience because of their interest in and knowledge of the program.

In December, Dr. Zink appeared on a local educational TV station and explained the role of TUSC in the economic development of southeastern Oklahoma.

On 16 November 1967 Dr. Zink appeared on a program at Baylor University, Waco, Texas, sponsored by the Texas State Technical Services activity and the Small Business Administration. The program was an all day affair for small businessmen designed to acquaint them with available technical information services. Representatives of several governmental agencies were present. Dr. Zink appeared as a member of one of the panel discussion groups.

Some 150 persons attended; approximately one half of these represented the business community. (The invitation to appear on this program came through a working contact with the Small Business Administration, Dallas.)

TUSC Staff

Dr. Jerold J. Morgan, associate professor of accounting in the Oklahoma State University College of Business has been added to the consultant staff. Dr. Morgan will be primarily concerned with assisting the director in devising new, more efficient management tools.

Mrs. Velma Dittmar began her duties as Administrative Assistant in October.

Specific Report Relating to Statement of Work in NSR 37-004-006

The following is a report relating directly to specific projects stated in the work statement of NSR 37-004-006. Numbers below are those used in the contract.

1. All previous sections of this Quarterly Status Report relate to this work statement.

2. No additional seminars were held during the quarter. Plans are underway to hold the fourth seminar during late February or early March, 1968. The conclusion has been reached that this kind of activity may not be a significantly useful mechanism in the process of technology transfer. As TUSC has used it, it may

be an important first step in acquainting potential clients with technology utilization; however, there may be more effective means of doing that.

3. In Quarterly Status Report No. 9, reference was made to a seminar planned for November in cooperation with the Oklahoma Technical Services Program. It was necessary to postpone this seminar a second time due to complications at the chamber of commerce in the host city. Current plans call for scheduling the seminar in February 1968.

4. The project to service clients outside the seventeen (17) county area by mail and telephone continued during the quarter at a somewhat slower pace. Three (3) firms in the Oklahoma City area were added, making a total of eighteen (18) firms being served. During this quarter, seven (7) retrospective searches were completed for these firms. Three (3) transfers, reported in the first report, were to this group (numbers 105, 111, 125). In order to find out how the information we provided to these firms was used, it was again necessary to personally contact each one involved. Our preliminary evaluation of this type of effort would, at this point, be negative. It appears that, at least during the first year of a client's dialogue with TUSC, a certain amount of personal, face-to-face contact, is absolutely necessary.

5. The relationship with the large firm has not been as active as the TUSC staff had desired. During the quarter, the firm has undergone an internal reorganization affecting the engineering department. As would be expected, this has hampered our dialogue with the firm. TUSC completed, at their request, only

two (2) retrospective and one (1) current awareness searches during the quarter. They have given an indication that the information TUSC provided will result in a totally new product to be placed on the market in the summer. The company appears to have great confidence in the new product and attributes a significant saving in engineering man hours to the information TUSC provided. TUSC needs additional, more specific information about this product and is attempting to obtain it.

6. During the quarter TUSC provided two (2) retrospective searches to other institutions engaged in the Oklahoma State Technical Services program. The OSTS program continues to move very slowly, although prospects for improvement appear somewhat brighter. Besides the field man working out of Southeastern State College and operating with TUSC cooperation, there is only one (1) other man covering the state.

7. Activity in providing services of the TUSC information center to faculty members at various institutions continued to increase. Twenty-two (22) faculty members at six (6) institutions have been served. During this quarter, eight (8) retrospective searches were provided to faculty users. Our efforts to obtain an objective evaluation of this service have not yet borne fruit. Faculty members appear somewhat hesitant to describe the uses to which they put the information. This problem is being pursued.

8. As mentioned previously in this report, the major portion of the updating of the regional economic data volumes has been completed. For that reason, support for the graduate student working on the project has been decreased by one-half. There is

important work remaining in this area; but due to limitation of resources, it will proceed slowly.

9. Activity in support of the Oklahoma State University pilot project decreased. TUSC provided five (5) microfiche and three (3) reports for that effort.

10. Little service was provided to the college aviation program during the quarter. As previously mentioned in this report, consideration is being given to expanding this program to include air controller training. TUSC has provided technical information for that endeavor.

11. No direct efforts were expended in cooperation with organizations operating under the Public Works and Economic Development Act of 1965.